

# The Ever-Changing Forest

**W**isconsin's forests—in the north and the south—are changing all the time due to growth of the forest, natural succession as forests mature, and disturbance from human actions, fire, weather, insects, diseases, and wildlife impacts. These are some of the dynamic forces at work in forests, and they have been part of forest ecology for many thousands of years.

Disturbance changes the forest's composition, structure and function. Different types, intensity, and frequencies of disturbance influence and change forest diversity at the genetic, species, ecosystem and landscape scales.

## Fire

Historically, fire was an important natural disturbance factor in Wisconsin's forests, both north and south. However, in the last 50 years, fire has been largely eliminated from the forest. In addition to protecting human lives and property from the effects of fire, this has also resulted in many significant changes in forest ecosystem composition, structure and function. Fire protection remains very important to people owning or living near forests. However, there is increasing awareness of the ecological importance of fire and more planned, managed fires are occurring in restoration areas.

Some ecosystems—such as oak savannas, barrens, and prairies—require fire to regenerate and maintain their species composition.

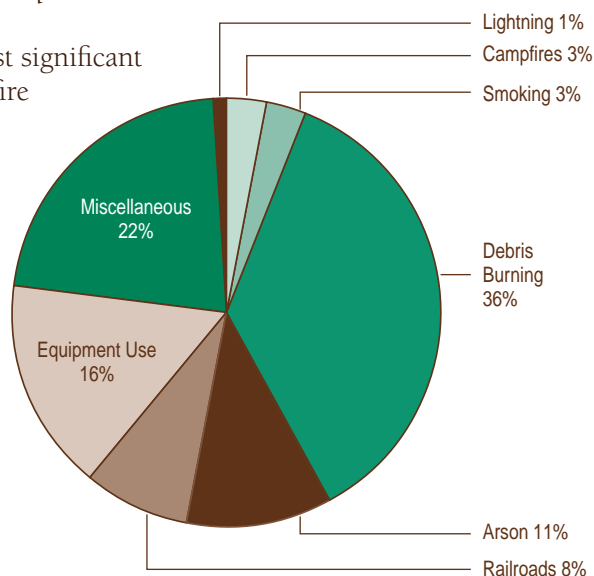
In the southern region of Wisconsin, fire was considered the most significant disturbance factor in pre-European settlement times. In the north, fire shared dominance with wind as significant disturbance factors. The aspen, pine, oak and birch forests in Wisconsin before the 1850s were a result of fire [USFS, 2000].

Although forest fires are now much less frequent than in the early 20<sup>th</sup> century, there are still many fires each year. Between 1992 and 1996 about 1,528 wildfires occurred each year, burning approximately 2,658 acres/year. Most fires are started by humans. The most common cause of wildfire is debris burning, followed by equipment use, and arson. Lightning causes just 1% of all of Wisconsin's wildfires. Wildfires are most likely to occur in the spring and early summer, from March to July, with April being the most likely month for wildfires [WDNR, 1998].



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*Fire is an important disturbance factor in forest systems. Protecting lives and property from fire has changed fire's impact on Wisconsin's forests.*



**Figure 24**

Causes of forest fires in Wisconsin in an average year



*Forests help maintain water quality by preventing erosion. Use of Best Management practices ensures that forestry activities do not contribute to nonpoint source pollution.*

## Hydrology

The state of Wisconsin has over 30,000 miles of rivers and streams and over 15,000 lakes. The glaciation of northern Wisconsin is responsible for creating the rich legacy of waterbodies and wetlands in our present landscape. Differential erosion of bedrock, irregular deposition of sands, gravels, silts, and clays, and the melting of ice blocks stranded by the retreating glacial ice left a landscape containing numerous lakes and streams. Covering an area missed by the glaciers in southwest Wisconsin is the Driftless Area, distinguished by classic dendritic stream patterns, few natural lakes, and sharper, more eroded terrain.

In general, forests help maintain water quality by holding soil and preventing erosion. Most of the highest quality streams and lakes in the state are in forests. However, there is the potential for nonpoint source pollution from forestry practices affecting the state's water resources [WDNR, 1995]. Nonpoint source pollution, which accounts for about half of all pollutants entering our nation's waters, occurs when water from rainfall or snowmelt moves across the ground, transporting pollutants into streams, lakes, wetlands, or groundwater. For example, soil becomes a nonpoint source pollutant when water erodes the soil and carries it to a stream. Eroded soil is the primary pollutant associated with forestry activities. Many uses can cause nonpoint pollution, including agriculture, mining, construction, urban and rural development, and forestry. In Wisconsin, it is estimated that only 3% of nonpoint pollution come from forestry practices. While forestry's contribution sounds small, localized impacts can be significant, such as logging road erosion into a trout stream.

Wisconsin's forestry best management practices (BMP's) for water quality are voluntary guidelines to help loggers, landowners and natural resource managers minimize nonpoint source pollution during forestry operations. The use of BMP's is a practical and cost-effective way to ensure that forestry activities do not harm water quality.

## Severe weather

Weather has a profound impact on Wisconsin's forests. Over long periods of time, weather forms the climate of an area. Climate is a primary determinant of the type of ecosystem developed in an area. Climate has changed and will continue to change over time. Warming or cooling will impact the composition and distribution of the forest. Since these changes usually occur over longer periods of time, this report will only discuss severe weather events. In forests, severe winters, drought, and windstorms perpetuate dynamic cycles.

Wind events, which cause phenomena aptly called forest blowdowns, are very significant sources of disturbance. For example, on May 31, 1998, a "derecho," a widespread, straight-line wind event, moved through parts of southcentral and southeast Wisconsin—the most damaging straight-line wind event to hit Wisconsin in 100 years. Hurricane-like winds, with gusts up to 100 mph, ripped through 12 counties in that part of the state. Thousands of large trees were uprooted, twisted, broken off, and downed by the winds. Usually, wind events are less dramatic, however they do account for much of the disturbance in Wisconsin's forests. Ice storms, hail storms and tornadoes also influence forests. Severe weather events can occur on a statewide scale, like



*Wind can cause damage to individual trees, or to large areas of forest. Wind storms are common damaging agents in Wisconsin.*

those mentioned above, but they are more common on local scales and impact Wisconsin forests on a regular basis.

Severe or unseasonable cold can also impact trees and forests. Hundreds of maples (sugar, red and Norway) died because of an extreme cold snap—as low as minus 56 degrees Fahrenheit—in February of 1996. Unseasonable cold during the spring also affects trees. It is believed that cool temperatures combined with high winds result in oak tatters, a condition resulting in oaks producing small, “chewed up” leaves in the spring. This can result in decreased vigor.

Drought can also have a significant impact on forests. The drought of 1988 and 1989 is responsible for much of the mortality of paper birch seen in the last decade. Drought-stressed trees were not able to survive the ensuing insect stress.

## Herbivory

Whitetail deer and snowshoe hare are important species in Wisconsin’s forests. Like most forest animals, they are herbivores—they eat plants. Usually herbivores help to maintain natural ecosystem functioning and enhance the health and quality of Wisconsin’s forests. However, in especially snowy winters, or when populations are very high, deer and hares can cause damage to the forest.

### WHITETAIL DEER

White-tailed deer is a keystone species in Wisconsin’s forests. Deer are a generalist species, living in almost all of Wisconsin’s terrestrial ecosystems, although they are more common in open areas and early successional forests. They eat a wide array of plant species, both woody and herbaceous. Favorite woody species include northern white cedar, eastern hemlock, basswood, white pine, yellow birch, sugar maple, red maple, aspen, oaks, white ash, and shrubs such as Canada yew, brambles, mountain maples, dogwood, viburnums, and hazel. Those which are known to be very sensitive to deer browse include northern white cedar, eastern hemlock, yellow birch and Canada yew. Deer also eat many herbs. In addition to grasses and sedges, deer eat at least 70 plant genera. [Christoffel, 1998 and Vander Zouwen et. al., 1995].



Darrell Zastrow & David Schultz



*This northern white cedar enclosed in the fence was protected from whitetail deer and snowshoe hare. The area adjacent to the fence was browsed clean of cedar.*

Keith McCaffery



*High concentrations of deer can severely damage forest vegetation. In severe winters, many deer starve after eating all available vegetation, except when they are fed by humans. Ashland.*

Deer have been shown to have significant impact on rare, threatened and endangered plant species. Rare orchid and lily populations have been documented casualties of deer herbivory [Waller et. al., 1997].

Deer have a direct effect on individual plants, but their effects on an entire ecosystem can also be significant. They can influence the future fertility of the soil by selecting for certain species against others, and the long-term reproductive capacity of various plants can also be affected. Once changes in the vegetation have occurred, changes in animal species may follow, as do changes in ecosystem function. For example, by over-browsing understory, deer can



remove cover and food sources for songbirds. When songbird populations decrease, predator populations are also likely to decline [Vander Zouwen et. al., 1995].

## SNOWSHOE HARE

Like deer, snowshoe hare is a generalist species. Hares thrive in many different types of habitat, especially edge habitat. Snowshoe hares have a 10-year population cycle, reaching a peak and then tapering off every decade. Bobcat and other predators hunt and feed on hare, and along with winter hardship are the primary check on hare populations.

In summer, snowshoe hares are a soft brown and feed on a wide variety of grasses and understory plants. Grasses, clover, dandelions, raspberries, and blackberries are favorite hare fare. When snow covers their usual summer browse, the winter white hares turn to trees for sustenance. They eat a variety of buds, twigs, and bark of broadleaf trees. Aspen, willow, birch, maple, sumac and alder are frequently eaten by hares. However, their preferred winter forage is conifers. Balsam fir, northern white cedar, eastern hemlock, spruces, and white pine are sought out by hungry hares.

In the forest, hares maintain open understory conditions. They can help renew the soil, and their nibbling can even encourage new growth, especially on undergrowth species. However, if local hare populations are very high, or if it's an especially hard season, hares can do significant damage to the forest. Hares are so voracious and prolific that they can chew away conifer regeneration, especially in nurseries or plantations where young trees are concentrated. Hare herbivory can prevent regeneration of these conifer forests after harvest, or disrupt other reforestation efforts.



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*Snowshoe hares are found in all forest types in northern Wisconsin.*

## Exotic species

Exotic species are those that have been introduced from beyond Wisconsin's borders. Often these exotic species are brought from other areas of the world. Wisconsin's forests have been assailed by a variety of introduced exotic species that have caused major disturbance in the forests. Exotic species can overwhelm the ecological capability of an area because they have not developed in conjunction with the natural ecosystem and there are frequently no checks on their populations. Exotic species can sometimes out-compete and crowd out native species, or infest local trees. Dutch elm disease, chestnut blight, the European gypsy moth, and the Asian long-horned beetle are some of the major exotic threats to Wisconsin's forests. In addition, plants such as garlic mustard and multiflora rose can completely take over a forest understory, effectively eliminating native plants from the area.

## Biodiversity

Biodiversity has also changed over time and will continue to change. It is important to recognize this change from the past in order to provide stewardship to Wisconsin's biodiversity. The following information provides a summary of changes that have occurred and the general status of our knowledge.



Robert Queen

*Forest biodiversity encompasses a wide array of species—plants, animals, and the less familiar fungi, bacteria, and protozoa. Shaggy mane mushroom.*



*The Karner blue butterfly is an endangered species that depends on wild lupine growing in young forests, barrens, savanna, and prairie. Management techniques focusing on maintaining disturbance-dependance habitat will help this species.*



*Agriculture and urban development have caused severe fragmentation of the state's forests, especially in the southern region.*

About 40 distinct Wisconsin terrestrial communities were described by John Curtis in the 1950s [Curtis, 1959]. Most of these are intact. However, savanna and barrens have experienced striking decline. Both savanna and barrens communities are listed on the globally recognized Natural Heritage Inventory's list of most threatened ecosystems (see Appendix 1).

Forests that have never been disturbed are also increasingly uncommon. In 1995, Frelich estimated that 58,500 acres—less than .4%—of Wisconsin's forests had not experienced severe human disturbance since European settlement. Seventy-nine percent of this area is white cedar forests; another 10% are black spruce-tamarack forest [Frelich, 1995].

There are estimated to be about 2,300 species of vascular plants in the state of Wisconsin. About 1,800 of these are native to the state, 22% are believed to be introduced exotics.

Six hundred fifty-seven species of vertebrates live in the state. In addition to these fairly conspicuous species, there are also thousands of species of non-vascular plants and invertebrates, as well as fungi, bacteria, and protozoa—most of which have not yet been adequately described or researched.

Human activities since European-American settlement have dramatically altered the distribution and abundance of many species. As of 1998, there were 241 species listed on the state's endangered or threatened list, and 15 Wisconsin species are on the federal endangered or threatened list (11 species appear on both lists). Of the plant species listed, 28% are forest species, all of the listed mammals are forest species, 50% of listed bird species are forest species, and 40% of listed reptiles and amphibians are forest species.

Two species were hunted to extinction—the passenger pigeon and the Carolina parakeet. Other species were extirpated from the state. Some remain extirpated—bison, wolverine, woodland caribou, Eskimo curlew, and whooping crane. Six have been reintroduced with varying degrees of success—elk, fisher, American marten, trumpeter swan, peregrine falcon, and wild turkey. Two species, moose and timber wolf, have returned to Wisconsin of their own volition. There have also been a few sightings of cougar in northern Wisconsin, although it is thought these animals are probably escapees from domestication.

## ECOLOGICAL SIMPLIFICATION, FRAGMENTATION AND ENVIRONMENTAL POLLUTION

Many of the impacts to the forests that have been described so far are naturally occurring events that are part of the ever-changing composition, structure, and function of the forest which do not permanently harm the overall balance of the system. Generally, sustainable forestry practices protect the fundamental vitality of the forest system by safeguarding water quality and ensuring robust regeneration. However, human pressures can fundamentally alter the composition, structure, and function of the forest ecosystem. For example, permanent changes in land-use can result in ecological simplification and fragmentation, while levels of environmental pollution have been increasing in quantities or at rates that may harm organisms, habitats, communities, ecosystems, or human health [DNR, 1995].